

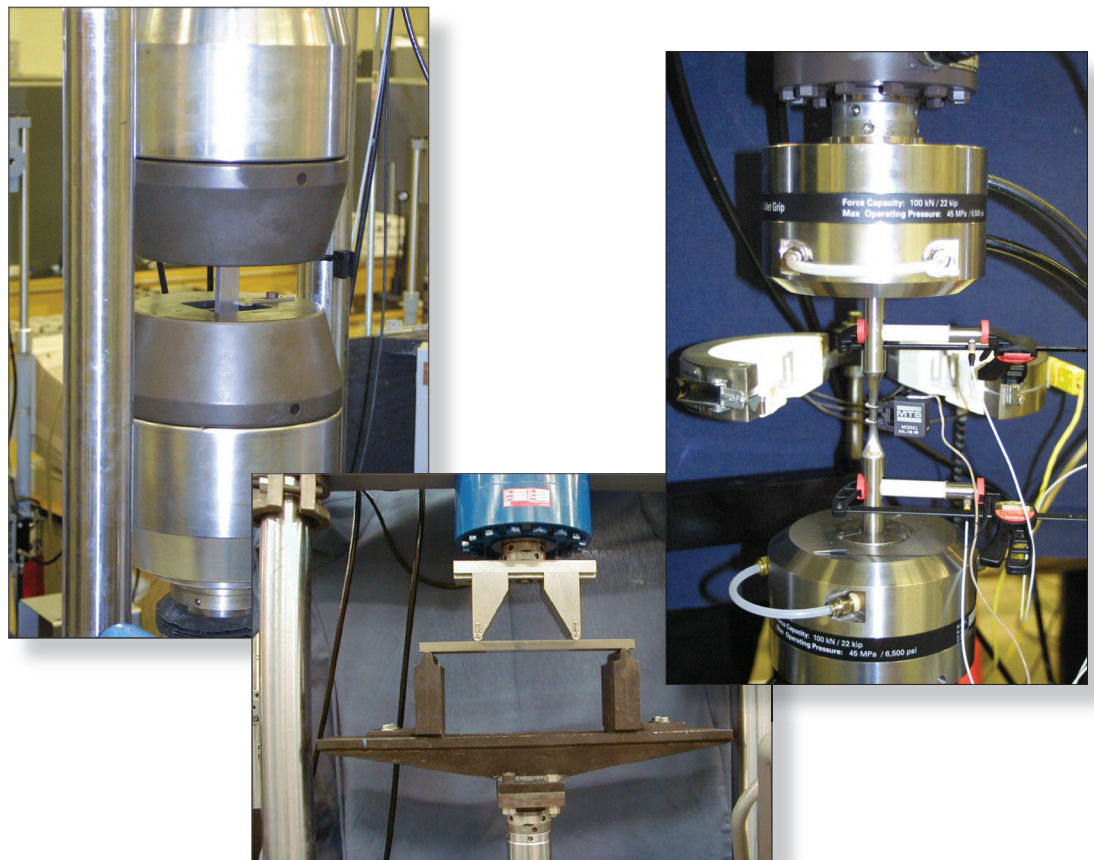


# Air Force Research Laboratory | AFRL

*Science and Technology for Tomorrow's Air and Space Force*

## Success Story

### ENGINEERS EVALUATE HIGH VELOCITY OXYGEN FUEL COATINGS FOR HIGH TEMPERATURE APPLICATIONS



Implementation of an electrolytic hard chrome (EHC) alternative for the rebuild, rework, and repair of worn turbine engine components will help to minimize the growing environmental compliance and disposal problems associated with the use of hexavalent chromium. Reduction of the use of chromium during Air Force Air Logistics Center maintenance operations will result in a significant reduction of worker exposure to this carcinogenic material.



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Wright-Patterson AFB OH

## Accomplishment

Engineers from the Materials and Manufacturing Directorate Systems Support Division conducted a project funded by the Air Force Materiel Command Weapon System Pollution Prevention Program to evaluate high velocity oxygen fuel (HVOF) thermal sprayed coatings as an alternative to EHC for elevated temperature applications. HVOF technology is the primary coating process that the Air Force is implementing to replace hard chrome plating. During this project, engineers evaluated the high-temperature metallurgical properties of HVOF and plasma-sprayed coatings, specifically tungsten carbide-cobalt (WC-17Co), Tribaloy 400 (Co-29 Mo-8Cr), and Diamalloy 3007 CrC20 (Ni20Cr) to determine their suitability as alternatives to EHC for gas turbine engine applications.

The results of this investigation demonstrated that the performance of HVOF-applied coatings is superior to that of plasma-sprayed coatings and equal to or better than that of EHC for the substrates and coatings evaluated. This project will help to facilitate the transition of HVOF coating technology into Air Force depot maintenance operations.

## Background

EHC plating is extensively used to rebuild, rework, and repair worn components during the overhaul of aircraft turbine engines. EHC plating provides a coating with desirable metallurgical properties such as hardness, wear resistance, corrosion resistance, and lubricity. However, EHC plating involves the use of hexavalent chromium, a known carcinogen. Federal and state regulatory agencies strictly control the use of hexavalent chromium, resulting in higher disposal costs and increased liability and risk for the Air Force.

The Air Force and other Department of Defense organizations are currently transitioning HVOF thermal spray technology to replace EHC plating. The Aeronautical Systems Center's Propulsion Environment Working Group (PEWG) is working with the major aircraft turbine engine manufacturers to transition HVOF coating technology. The Directorate Pollution Prevention Group (MLSC) established the high-temperature HVOF applications project to complement the PEWG program by providing in-depth materials and metallurgical analysis of the elevated temperature performance of HVOF-applied coatings and the effect of the process on the substrate being coated.

## Additional information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (04-ML-07)